The square wave's spectrum is shown by the bolder set of lines centered about the origin. The dashed lines correspond to the frequencies about which the spectral repetitions (due to sampling with $T_S = 1$) occur. As the square wave's period decreases, the negative frequency lines move to the left and the positive frequency ones to the right.

**Solution to Exercise 5.3.3**

The simplest bandlimited signal is the sine wave. At the Nyquist frequency, exactly two samples/period would occur. Reducing the sampling rate would result in fewer samples/period, and these samples would appear to have arisen from a lower frequency sinusoid.

**Solution to Exercise 5.4.1**

The plotted temperatures were quantized to the nearest degree. Thus, the high temperature's amplitude was quantized as a form of A/D conversion.

**Solution to Exercise 5.4.2**

The signal-to-noise ratio does not depend on the signal amplitude. With an A/D range of [−A, A], the quantization interval

$$\Delta = \frac{2A}{2^B}$$

and the signal's rms value (again assuming it is a sinusoid) is

$$\frac{A}{\sqrt{2}}.$$

**Solution to Exercise 5.4.3**

Solving $2^{-B} = .001$ results in B = 10 bits.

**Solution to Exercise 5.4.4**

A 16-bit A/D converter yields a SNR of $6 \times 16 + 10\log 1.5 = 97.8$ dB.

**Solution to Exercise 5.6.1**

$$\begin{aligned} S\left(e^{j2\pi(f+1)}\right) &= \sum_{n=-\infty}^{\infty} \left(s(n)e^{-(j2\pi(f+1)n)}\right) \\ &= \sum_{n=-\infty}^{\infty} \left(e^{-(j2\pi n)}s(n)e^{-(j2\pi fn)}\right) \\ &= \sum_{n=-\infty}^{\infty} \left(s(n)e^{-(j2\pi fn)}\right) \\ &= S(e^{j2\pi f}) \end{aligned}$$

(5.56)

**Solution to Exercise 5.6.2**

$$\alpha \sum_{n=n_0}^{N+n_0-1} (\alpha^n) - \sum_{n=n_0}^{N+n_0-1} (\alpha^n) = \alpha^{N+n_0} - \alpha^{n_0}$$